



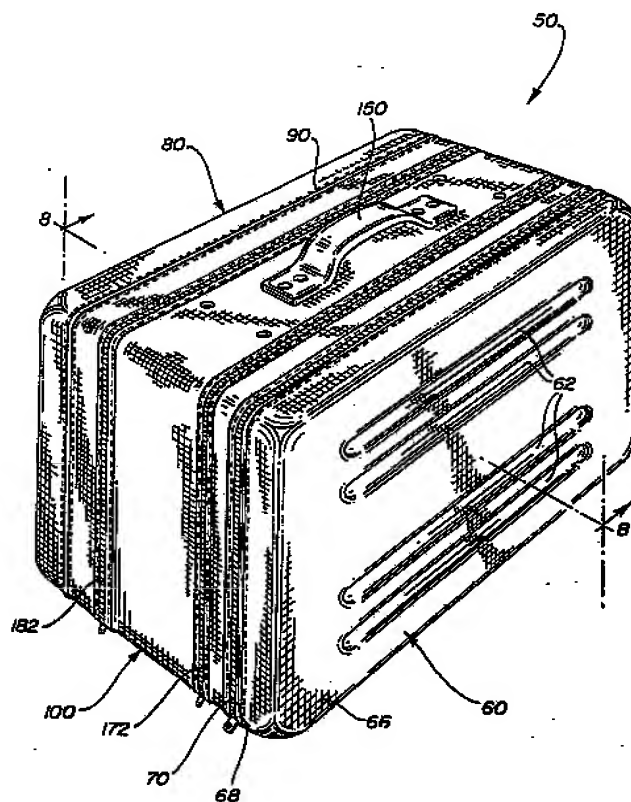
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|  |           |  |
|--|-----------|--|
| <b>(51) International Patent Classification 5 :</b><br><b>B29C 43/04, 47/06, B32B 31/20</b>  | <b>A1</b> | <b>(11) International Publication Number:</b> <b>WO 93/05943</b><br><b>(43) International Publication Date:</b> 1 April 1993 (01.04.93)  |
| <b>(21) International Application Number:</b> PCT/US92/08095<br><b>(22) International Filing Date:</b> 23 September 1992 (23.09.92)<br><b>(30) Priority data:</b><br>764,794 24 September 1991 (24.09.91) US<br><b>(71)(72) Applicants and Inventors:</b> CHANG, S., J. [KR/KR];<br>13-3, Sanjung-dong, Joon-ku Burchun City, Kyunggi-do<br>(KR). BERMAN, Joseph, J. [US/US]; 55 Mountain<br>View Terrace, Hillsdale, NJ 07642 (US).<br><b>(74) Agent:</b> WEINGRAM, Edward, R.; Weingram & Zall, P.O.<br>Box 927, Maywood, NJ 07607 (US). |           | <b>(81) Designated States:</b> AU, BR, CA, JP, European patent (AT,<br>BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC,<br>NL, SE).<br><br><b>Published</b><br><i>With international search report.</i> |

**(54) Title:** SOFT GUSSET, HARD-PANELED LUGGAGE AND METHOD OF MANUFACTURE

**(57) Abstract**

A formed panel (12) for a bag (50) and method of manufacturing therefor is provided which allows the bag (50) to maintain an original shape without deformation even though the bag may be acted on by external forces, and also allows the bag (50) to appear soft from the outside thereof. The panel (12) is formed from the impression of a fabric material (2) onto a rigid plastic material (1). Also provided is a hard-sided, soft-gusseted luggage to protect the contents of the luggage without a totally rigid construction. A method of manufacturing is provided a hard panel for luggage which includes impressing a fabric sheet (2) onto a plastic sheet (1) to form a combined sheet and molding the combined sheet to the desired shape. In another embodiment, a formed panel (12) is made from an outer fabric (304), a substrate (305) and an inner fabric (306), all of which are separately formed and then adhered together.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

|    |                          |    |                                       |    |                          |
|----|--------------------------|----|---------------------------------------|----|--------------------------|
| AT | Austria                  | FI | Finland                               | MN | Mongolia                 |
| AU | Australia                | FR | France                                | MR | Mauritania               |
| BB | Barbados                 | GA | Gabon                                 | MW | Malawi                   |
| BE | Belgium                  | GB | United Kingdom                        | NL | Netherlands              |
| BF | Burkina Faso             | GN | Guinea                                | NO | Norway                   |
| BG | Bulgaria                 | GR | Greece                                | NZ | New Zealand              |
| BJ | Benin                    | HU | Hungary                               | PL | Poland                   |
| BR | Brazil                   | IE | Ireland                               | PT | Portugal                 |
| CA | Canada                   | IT | Italy                                 | RO | Romania                  |
| CF | Central African Republic | JP | Japan                                 | RU | Russian Federation       |
| CG | Congo                    | KP | Democratic People's Republic of Korea | SD | Sudan                    |
| CH | Switzerland              | KR | Republic of Korea                     | SE | Sweden                   |
| CI | Côte d'Ivoire            | LI | Liechtenstein                         | SK | Slovak Republic          |
| CM | Cameroon                 | LK | Sri Lanka                             | SN | Senegal                  |
| CS | Czechoslovakia           | LU | Luxembourg                            | SU | Soviet Union             |
| CZ | Czech Republic           | MC | Monaco                                | TD | Chad                     |
| DE | Germany                  | MG | Madagascar                            | TG | Togo                     |
| DK | Denmark                  | ML | Mali                                  | UA | Ukraine                  |
| ES | Spain                    |    |                                       | US | United States of America |

5  
Title: SOFT GUSSET, HARD-PANELED LUGGAGE  
AND METHOD OF MANUFACTURE

S P E C I F I C A T I O N

10 RELATED APPLICATIONS

This application is a Continuation-In-Part application of pending U.S. Application Serial No. 07/764,794, filed September 24, 1991, which is a Continuation in Part application of U.S. Application  
15 Serial No. 07/702,950, filed May 20, 1991, now abandoned.

BACKGROUND OF THE INVENTION

Field of the Invention

20 The present invention relates to a formed panel for a bag and method of manufacturing therefore, and more particularly, to a formed panel for a bag and method of manufacturing therefore which allows the bag to maintain an original shape without deformation even though the bag may be acted on by external forces, and also allows the

bag to appear soft from the outside thereof.

This invention also relates to luggage, and more particularly hard-sided, soft gusset luggage having durability and sufficient stiffness to protect the contents of the luggage without a totally rigid construction.

#### Description of Related Art

In general, when a bag is manufactured with the use of a panel formed by extruding Acrylic Buterate Styrene (ABS), Poly Vinyl Chloride (PVC), Poly Ethylene (PE), Poly Propylene (PP) and pack, the bag is able to maintain an original shape without deformation by external force. Also, when a bag is made of material such as leather, vinyl, fabric or the like, it is easily deformable by external force.

According to the former case, it is possible to maintain the original shape of the bag, even if the bag is pressed by external forces. This results in the advantage that the contents of the bag can be maintained in their proper shape. Accordingly, this type of bag is generally used as a traveling bag, a bag for instruments, etc. Since the material of the formed panel is generally a hard plastic such as ABS, PVC, PE, PP, pack and so on, though the bag can be maintained in its original shape,

it is a disadvantage that the outward appearance of the bag is unpleasant to the touch.

In the other case, where materials such as leather, vinyl, fabric or the like are used for manufacturing the bag, the outward appearance of the bag is agreeable to the touch, but when external force is applied to the flexible material, the force is directly transferred to the contents of the bag.

In order to overcome the disadvantage of the later case, it has been suggested that a structure with a square frame be inserted into the body of the bag to maintain a shape of the bag. While this structure maintains, partly, a square shape, it is incapable of maintaining the contents in the bag in their original form.

Soft-sided luggage has many advantages but also provides many problems which are inherent in its structure. Soft-sided luggage, normally referred to as luggage having a hard gusset or midsection and soft panels in front and back, must be filled full in order for the contents of the luggage and the front and back panels to be protected. If the luggage is not filled, voids occur which leave the soft front and back panels vulnerable to puncture or ripping. While such luggage is light in weight, it is bulky because of the stiffness and

5 volume of the gusset. Additionally, the structure of soft-sided luggage requires rigid frames for closing the front panel to the gusset, which frames tend to bend because of the lack of strength of the front panel, leading to the bags often being bent and deformed.

10 Appearance problems also exist if the luggage is not carefully manufactured. If a hard gusset is used in the center section, then the hard section must be covered with the same soft material that is used to form the panels. If, on the other hand, the luggage is to have hard panels all around, then very often the panels are made of plastic and the entire luggage tends to appear cheap and shoddy. If cloth is used in the luggage, then the luggage will have a soft appearance and will in fact be soft in the front and back panels and require separate structural stiffeners.

15 Additionally, flexible or soft-sided luggage is not necessarily expandable even though the sides are soft. Since the luggage must be relatively full in order to keep the sides from becoming vulnerable to puncture or ripping, it is necessary that the soft-sided luggage be very accurately sized to the load involved. Attempts have been made in the past to expand the luggage in accordance with the size of the load being carried but these attempts have been less than successful.

20

25

Furthermore, none of these patents, taken either singly or in combination, are thought to provide the benefits of the present invention.

Trotter, U.S. Patent No. 1,171,678, shows a rigid piece of luggage having an expandable side panel by placing flexible sheet within the remainder of the luggage and strapping the two together.

Switkes, U.S. Patent No. 1,889,765, shows a bellows expansion panel for the outside of an attache case.

Gray, U.S. Patent No. 2,536,169, shows a device having two zippered halves connected by a zipper, so that the middle of the apparatus is flexible while the outer panels are relatively stiff. Provisions are made for inserting zip and expansion panels into the device to make the device of larger capacity.

Miller, U.S. Patent No. 3,061,057, is a device which has add on segments zipped together to a soft, flexible center.

Dyke, U.S. Patent No. 3,443,671, shows an expansible carrying case having asymmetrically opening zippered pleats to enable expansion.

Kotkins, Jr., U.S. Patent No. 4,773,515, shows a device having zip on expansion chambers at the ends of the device.

The related art does not provide the essential elements or benefits of the present invention.



SUMMARY OF THE INVENTION

In order to overcome the problems of the prior patents, the present invention sets forth a light weight soft luggage having hard protective panels on the front and back sides which are attached to a fabric gusset section. The flexibility of the fabric in the gusset section allows for the hard front and back panels to orient themselves with respect to the loading of the contents in the luggage and allows for collapsing of the luggage when empty and enables expansion of the luggage when necessary.

Additionally the present invention sets forth a method of manufacturing luggage in which hard front and back panels are formed by molding plastic and a cloth cover to form the external surface of the panel. The rear panel is then sewn to a cloth gusset section using standard welting technology. The front panel has a hinge section sewn to it and the front of the gusset section and has a mating zipper sewn to the remaining edges of

the front panel and the front portion of the gusset. A metal stiffening band is mounted in the gusset and the luggage handle is fastened through the gusset to the stiffening band.

5           According to an embodiment of the present invention, raw material is adhesively deposited on a resin panel and the resultant composition is heated for 30 to 50 seconds at 120°C to 140°C. After the heating process has been completed, the resultant composition is extruded and  
10           formed by using a metal molding press, the formed product is cooled and then the scrap is removed from the formed product to obtain the formed panel.

15           In forming of the formed panel according to another embodiment of the present invention, raw material such as fabric, vinyl or the like is adhesively deposited on a resin panel which is extracted from an injection molding machine and the resultant structure is extruded so that the raw material can be deposited on the resin panel. After that, a cooling and carrying process is performed

on the resultant structure and the resultant formed product is cut to predetermined lengths through a cutting process.

5 According to the first embodiment of the method as described above, when leather or patterned fabric is used as a raw material, it will be apparent that an advantage that is provided is that a worker can directly align the patterns on fabrics or the connecting parts of leather.

10 Further, in case of the second embodiment of the method as described above, since the raw material is directly deposited on the resin panel and then the extruding process performed, mass production may be achieved.

15 In another embodiment of the present invention, lengths of fabric material and a substrate are cut to size, formed, and then pressed together. The laminate construction is held together by means of an adhesive between the layers of fabric and the substrate. By forming the shape of the components of the panel prior to

adhering the components together, wrinkling and stretching of the fabric material is reduced. Additionally, a spring loaded frame may be used to further reduce such wrinkling.

5 Accordingly, it is an object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is light in weight.

10 It is an object of the present invention to provide a formed panel for a bag and method of manufacturing therefore in which a raw material such as fabric, leather, vinyl or the like is adhesively deposited on a resin panel which is extruded to form a basic panel for a bag, so that the bag provides a soft feel in its  
15 outward appearance, while not permitting deformation even though external forces are applied.

It is also an object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which

piece of luggage is durable.

It is another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is strong.

It is even another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is inexpensive to fabricate.

Even another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is expandable beyond its normal size when full.

Yet another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is collapsible when empty.

Still another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is flexible.

5 A further object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage has few complex parts and is of simplified construction.

10 Even a further object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage has a simplified construction that allows for simplified assembly.

15 An additional object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage allows for the components thereof to be sewn to form the entire luggage and which allows for the

luggage to be opened and closed by means of a zipper.

Another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage has a zipper closure with hard side advantages.

Even another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is impervious to the crushing of the contents or the puncture or ripping of the front and back panels.

Yet another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage has a strong handle.

Still another object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage which is hard sided with the major

components thereof sewn together.

It is also an object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage is cloth covered and has rigid front panels and back panels, and a flexible central section.

Additionally it is an object of the present invention to provide a luggage constructed with a flexible gusset section and relatively rigid front and back panels, which piece of luggage does not require external or internal stiffening sections for the front and rear panels.

It is also is an object of the present invention to provide a method for manufacturing and assembling an article of luggage having rigid front and back panels with a simplified method of construction.

It is another object of the present invention to provide a method for manufacturing and assembling an article of luggage which molds cloth to plastic to form



hard front and back panels that have cloth surfaces for durability and an attractive appearance.

It is still another object of the present invention to provide a method for manufacturing and assembling an article of luggage which allows for the sewing together  
5 of the major components.

It is yet another object of the present invention to provide a method for manufacturing and assembling an article of luggage which allows for zipper closure  
10 thereof.

It is a further object of the present invention to provide a method for manufacturing and assembling an article of luggage which is sequenced for ease of assembly.

5 It is even a further object of the present invention to provide a method for manufacturing and assembling an article of luggage which is sequenced for inexpensiveness in the cost of assembly.

10 It is still a further object of the present invention to provide a method for manufacturing and assembling an article of luggage which does not require precision parts for the assembly thereof.

15 It is yet another object of the present invention to provide a method for manufacturing a panel for an article of luggage wherein the panel has an outer fabric and which method reduces wrinkling of the outer fabric.

These, as well as further objects and advantages of this invention will become apparent to those skilled in the art from a review of the accompanying Detailed

Description of the Preferred Embodiments, reference being made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a view illustrating a processing sequence of a first embodiment according to the present invention;

5 Figure 2 is a perspective view of a formed product according to the present invention;

Figure 3 is a perspective view of a formed panel with the scrap cut away from the product of the present invention;

10 Figure 4 is an enlarged, vertical, cross-sectional view of a formed panel of the present invention as taken along line 4-4 of Figure 3;

Figure 5 is a perspective view illustrating an actual application of a formed panel according to the present invention;

15 Figure 6 is a manufacturing process view illustrating a second embodiment of the present invention;

Figure 7 is a perspective view of an embodiment of

the luggage of the present invention;

Figure 8 is a cross-sectional view of an embodiment of the luggage of the present invention as taken along line 8-8 of Figure 7;

5        Figure 9 is an enlarged view of Portion C of Figure 8;

Figure 10 is a perspective view of another embodiment of the luggage of the present invention;

10       Figure 11 is a perspective view of another embodiment of the luggage of the present invention;

Figure 12 is an enlarged view of Portion D of Figure 11;

15       Figure 13 is a schematic view illustrating the procedure for preparing fabric for use in connection with a third embodiment of manufacturing a formed panel of the present invention;

Figure 14 is a cross-sectional view of the fabric and mold for forming the fabric for the formed panel of the present invention;

Figure 15 shows the cross-sectional view of the fabric and mold for forming the second fabric for the formed panel of the present invention;

Figure 16 shows the welting attached to the outer formed fabric for the panel of the present invention;

Figure 17 is a cross-sectional view of the outer formed fabric of the panel shown in Figure 16 taken along line 17-17;

Figure 18 is a cross-sectional view of the substrate and mold for forming the substrate for the panel of the above-referenced invention; and

Figure 19 shows the components of the formed panel of the present invention and the mold for pressing the components together to form the panel of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will be now described with reference to the accompanying drawings.

First Embodiment

Referring to Figure 1, a resin panel 1 is preferably made of a material such as Acrylic Buterate Styrene (ABS), Poly Ethylene (PE), Poly Propylene (PP) and pack, which are hard and partly contained components of rubber. A flexible material, such as fabric, leather, vinyl or the like, is used as a raw material to be deposited on the resin panel.

In this embodiment, an adhesive agent 3 is coated on the resin panel 1, the panel 1 is cut to a predetermined size and the raw material 2 is then adhesively deposited on the resin panel 1.

Next, the resin panel 1 and raw material 2 composition, is loaded into press 4, on the upper side of

5 a heating plate of press 4 and then the resin panel 1 is pressed by a pressing plate 5. During this operation, the temperature of the pressing plate 5 and the upper side 6 of the heating plate and press 4 are all preferably between 120°C and 140°C and the pressing time is approximately 30 to 50 seconds.

10 Next, the heat-processed resin panel 1 is formed by the molding press 9, typically a plug-molding press. The molding press 9 includes an upper metal molder 7 and a lower metal molder 8. Preferably, the upper and lower molders 7 and 8 are replaceable and are shaped as male and female components to correspond to the shape of the panel for the bag to be formed.

15 Accordingly, the flexible resin panel 1, with the raw material 2 adhered thereto, is passed through the heating plate and press 4, is loaded on the lower metal molder 8 of the molding press 9 and then the resin panel 1 is extruded and formed by applying the upper metal molder 7, thereto.



The resultant formed product 10 is cooled by a cooling apparatus, not shown, and the scrap 11 about the periphery of the resin panel 1 is cut off to thereby obtain the formed panel 12 as shown in Figure 3.

5 The formed panel 12 is, by means of the extruding and forming process, as shown in Figure 4, integrally coated with the flexible raw material 2 such as fabric or leather, while the inner surface is coated with a hard material such as ABS, PE, PP and pack, to provide the  
10 panel with a soft feel at the outside thereof and with rigidity against external forces.

Accordingly, if the panel is used for manufacturing a traveling bag, as shown in Figure 5, additional accessories may be attached to the bag without departing  
15 from the spirit or scope of this invention, nor without relinquishing the advantages of the invention.

The present invention is not limited to a traveling bag. It will be apparent that the present invention can be adapted for use in manufacturing various kinds of

bags, such as a bag for instruments, gun cases, wash implement bags, sports bags, camera bags, etc.

### Second Embodiment

Figure 6 shows an alternative system in which the raw material 2 is applied and adhered to the resin panel 1 during the resin extruding process, to thereby allow mass production to be achieved.

More particularly, the first embodiment as described above can be adapted to position or align the raw material when it contains patterns which must be aligned when the raw material is leather, whereas the second embodiment allows the raw material to be sequentially adhered to the resin panel.

Referring to Figure 6, the raw material is supplied into a hopper of the extruder 20 and a scrolled raw material is put into contact with the resin panel extruding from the extruder 20. The raw material is adhered to the resin panel by passing the two components,

together, through a plurality of guide rollers 22, 22' and 22".

Next, the resultant composition is transferred through a cooling carrying conveyer 23 and a preserving unit 24 to a cutter 25, which automatically cuts the composition to predetermined lengths. The cut panels are guided by a carrying conveyer 26 to a store room 27.

According to this embodiment, a special adhesive agent is unnecessary for attaching the raw material to the resin panel 1 as shown in Figure 4.

The panels stored in the store room 27 are cut down to the desired shape. The panels may then be used as shown in Figure 5 as a side panel.

Alternatively, the present invention contemplates the formation of the shape of the panel by vacuum-molding the resin panel and the raw material.

As described above, this invention provides a formed panel for a bag which allows the bag to maintain its original shape and resist deformation from pressure by

the application of external forces, while still feeling soft in its outward appearance. This invention has uses with many different types of bags including traveling bags, wash implement bags, camera bags, etc.

5 Referring to Figure 7, a piece of luggage generally indicated at 50 as shown, having a front panel generally indicated at 60 and a rear panel generally indicated at 80 connected to a central soft gusset section generally indicated at 100. The front panel has several stiffening  
10 ribs 62 molded into it to add rigidity to it. Stiffening ribs 82 are also present in the rear panel. The front panel is connected to the gusset section 100 by means of a zipper closure 70 which is used to close and  
15 shown. It may have one or two slides depending on the choice of the designer.

The rear panel 80 is connected to the central gusset section by means of welting 90, as will be explained in greater detail hereinafter. A handle 150, is connected

to the top of the luggage in a manner also to be described.

Referring to Figures 8 and 9, the front panel is made of an inner hard-plastic shell 64, by the method previously described and has a cloth outer surface 66. Welting 68 joins the front cover 60 to the gusset 100 by conventional means, namely with leg 72 being sewn by threads 73 to the front panel 60 and by threads 75 which sew together the gusset 100 and the other leg 74 of the welting.

The zipper 70 is sewn to the gusset 100 and to the front panel 60 in a standard conventional manner.

The rear panel 80 is of the same shape and form as the front panel 60. It has stiffening ribs 82 and includes a hard inner panel 84 with a molded cloth outer surface 86.

Welting 88 connects the rear panel 80 to the rear of the gusset section 100 in the same manner as the welting 68 connects the front panel 60 to the gusset section 100,

i.e. welting 88 includes a panel leg 92 and a gusset leg 94 which are sewn to the back panel and the gusset by threads 93 and 95 respectively.

5 Gusset section 100 is relatively flexible and is typically made of a soft material 102 such as cloth or other durable material which allows it to flex or fold. The gusset section has a stiffening bar 120 which is a continuous metal bar that extends completely around the  
10 gusset, contacting the inside top and bottom and side surfaces of the gusset to give the gusset some shape and to act as a support for the handle 150 which is connected thereto, to support the luggage via a top plate 140 which acts to reinforce the fastening means.

15 A bottom plate 130 is also provided to add sufficient rigidity to the bottom of the gusset section to prevent the gusset section from collapsing. Bottom plate 130 is connected, in turn, to the stiffening bar 120.

The bottom plate can be used for the fastening

wheels 160 thereto, if desired. The wheels can be attachable or detachable as desired.

As can be seen, by having a soft and flexible gusset section of the middle of the luggage, the front and back panels 60 and 80 are free to move and to basically conform the gusset section around the load contained in the luggage. The contents of the luggage will be protected by the front and back panels and application of an external force to the panels will not cause any source of stress concentration on the luggage contents, as the panels are free to move because of the flexibility of the gusset section. Therefore, any sharp impacts against the panels will be resisted by the panels and the panels will act to distribute the load among the internal contents of the luggage.

Additionally, as shown in Figure 8, the gusset section has two expansion darts 170 and 180 respectively. Dart 170 is in the front portion of the gusset and dart 180 is in the rear portion of the gusset. The expansion

5 darts are closed, typically, by zippers 172 and 182 respectively which are formed on the edges of the darts and which are continuous around the circumference of the gusset section. Note that the darts are disposed beyond the edges of the bottom plate 130. Opening the darts allows the gusset section to expand, if necessary, to increase the volume of the luggage. When the need for the larger luggage no longer exists, the darts can be closed to shrink the size of the luggage.

10 Other Embodiments of the Invention

15 In another embodiment of the invention, as shown in Figure 10, the hard outer panels can have separate pockets sewn to them. In Figure 10, a front panel 260 of luggage, generally indicated at 250, has stiffening ribs 262 molded thereon with the front panel 260 being formed from a hard inner panel 264 having a cloth outer covering 266 in the same manner as previously described.

In this embodiment, attached to the outer cloth



panel 266 are pockets generally indicated at 280 and 284, which pockets have upper and lower sections 281 and 283 which sections are connected by a zipper 282. Pocket 284 has upper portion 285 and 287 connected by zipper 286. The pockets are formed by sewing them to the outer fabric cover 266 prior to the molding of the cover to the hard inner panel 264. The pockets could, however, be stitched directly through the hard plastic layer. Importantly, the panel is sufficiently rigid to support the pockets and maintain their shape when they are fully loaded.

Figure 11 shows another embodiment of the invention, wherein luggage, generally indicated at 350 has a soft central section 400 with a handle 450.

The luggage has one or more hard panels constructed by the method previously described. Shown in this embodiment of the invention are two hard panels, although it should be understood that the outermost panel could be soft rather than hard. The hard panel generally indicated at 360 has stiffening ribs 362 and it is formed

from a hard inner shell 364 with a cloth outer covering 366. Welting 368 connects the outer panel 360 to the soft, inner gusset-like section 401. A zipper generally indicated at 470 is used to close the outer or the extreme container generally indicated at 351.

The rear panel is, preferably, also a hard panel as shown in the broken away portion D of this figure. This panel is somewhat different from the rear panel of the embodiments previously described in that it is relatively flat and joined at two ends, as shown in Figure 12, with a double row of welting in which the rear panel generally indicated at 380 includes inner hard panel 384 with the outer soft portion 386. The rear panel is connected to the bag 400 by means of welting wherein welting 388 has legs 389 and 390 which are connected to the fabric of the bag 400 and the hard panel 380, respectively, by means of stitching, and a second welting 392 that has one leg 393 connected to the hard panel 380 and the other leg 394 connected to the inner gusset-like section 401 of the end

container.

The same basic principles of the luggage apply to this embodiment in that there is a soft gusset that allows for movement of the hard panels to conform around the contents of the luggage and to thereby protect the contents by distributing any externally applied load among the contents.

#### ADDITIONAL EMBODIMENT OF METHOD FOR FORMING PANEL

As set forth in Figures 13-19, the present invention includes an additional embodiment for forming a panel for a bag or luggage. The panel formed by this method has a generally rigid structure with a soft texture on the outside and inside thereof. As such, the panel may be used with a bag or luggage which allows the bag or luggage to maintain its original shape and resist deformation from pressure while providing a soft outer and inner surfaces comprising a soft fabric.

As shown in Figure 13, the method of manufacturing

5 the formed panel of this embodiment of the present invention comprises dividing a fabric to form the top side and the bottom side of the formed panel and a dividing substrate for the formed panel into sized pieces. Such sized pieces may be formed in any manner generally known in the art. One way of manufacturing the sized fabric 300 is by pulling a fabric sheet 302 from a fabric roll 301 and passing it through a pressure roller 310 and an adhesive roller 312 to apply adhesive 318 to one side of the fabric from an adhesive tank 314 via a lift-off mechanism 316. Then the fabric sheet 302 is drawn across a dryer 320 such as an oven where the adhesive is dried. Next, the fabric sheet 302 is drawn through a knife cutter 324 which cuts the fabric sheet 302 into sized fabric 300. The sized fabric 300 is the proper size for formation into a panel.

10 15 While any fabric desired may be used, typically the fabric is formed of nylon, polyester, acrylic, cotton, wool, woven polypropylene or the like. The adhesive 318

may be any adhesive that is known in the art, although it is most desirable for the formed panel of this embodiment that a contact adhesive be used. It should also be noted that pressure roller 310 is utilized for controlling the quantity of contact adhesive 318 applied to the fabric sheet 302. It should be noted that the outer and inner fabric surfaces of the formed panel are both formed in an identical procedure.

The sized fabric 300 with adhesive 318 on one side thereof is further processed in a mold shown in Figure 14. The mold comprises a female mold 430 and a male mold 350. The sized fabric 300 is positioned between the mold components and a heater 330 is placed along the sized fabric 300 at the side with the adhesive 318 thereon. The heater 330 heats the adhesive 318 to transform the adhesive 318 from a relatively rigid substance to a relatively pliable substance. After such transition, the heater 330 is removed and the mold is closed.

The male mold 350 includes spring loaded rollers

352. Spring loaded rollers 352 help to reduce the wrinkling and/or stretching of the fabric 300 that was associated with the formed panels of the prior art. The spring loaded rollers 352 comprise a roller 353, a spring 354 and spring guides 355. Upon closing the mold, the female mold 340 and male mold 350 are brought together. The clamping surface 342 of the female mold 340 contacts the outer edge of the sized fabric 300 and pushes the ends of the sized fabric 300 against the rollers 353 of the spring guided roller 352. As closing of the mold continues, the rollers 353 roll along the bottom surface of the sized fabric 300 and move out of the path of the closing male and female molds. The resistance of the spring loaded rollers 352 is determined in part by the spring constant of the spring 354 and the spring guides 355. The spring loaded rollers permit the male and female molds 350 and 340 to be eased together to form the sized fabric 300 to its desired shape while reducing wrinkling and stretching of the sized fabric 300.

5 It should be noted that the female mold 340 may have ridges 341 which would correspond to similar ridges in female mold 340 so that the sized fabric 300 would be formed to its desired shape with ridges therein to provide strength and/or decoration to the final formed panel product. Similarly, the male mold 350 could contain such ridges with corresponding recesses in the female mold so that the sized fabric 300 was formed with ridges extending outward therefrom.

10 Upon forming the sized fabric to its desired shape, any scrap material is cut from the edges of the outer formed fabric 304. Typically, such cutting would be done with a die cutter. It should also be noted that after being formed, the adhesive 318 on the outer formed fabric 15 304 cools and rehardens such that the outer formed fabric 304 becomes relatively rigid.

Next, as shown in Figures 16 and 17, a welting 345 is attached to the outer formed fabric 304 as discussed herein with respect to the construction of the luggage.

5 The welting 345 provides a means for attachment of the final product to the gusset of the luggage. The welting is typically comprised of a wire core surrounded by a PVC shell. The welting 345 may be attached to the outer formed fabric 304 by sewing, heat welding, or any other method known in the art.

10 The inner fabric material comprising the inside of the formed panel is made in a similar way to the outer formed fabric 304. The sized fabric 300 is prepared in the same way for the inner and outer portions of the formed panel. However, as shown in Figure 15, the sized fabric 300 is positioned within a mold having a female component 341 and a male component such that the side of the sized fabric 300 having glue 318 is facing away from the male mold 350. Like the step of forming the outer form fabric 304, a heater 330 is positioned in proximity to the side of the fabric 300 having glue 318 to heat the adhesive 318 to change the sized fabric 300 from a relatively rigid construction to a relatively pliable

15



construction. After the sized fabric 300 becomes pliable, the heater 330 is removed and the female mold 341 and male mold 350 are closed to form the sized fabric. As the mold closes, spring loaded rollers 352 comprising a roller 353 and a spring 354 contact the lower surface of sized fabric 300 and roll along the bottom surface as the female mold and the male mold close. The spring loaded rollers 352 allow for the male and female mold to be eased together and for the sized fabric to wrap about the male mold to reduce stretching and wrinkling of the sized fabric 300 as it is formed into inner formed fabric 306.

As shown in Figure 14, the female mold 341 is of an open frame construction to reduce interference between the adhesive 318 and a mold surface. It should also be noted that the inner formed fabric 306 could be formed to contain ridges and/or could contain extended notches to provide for dividers within the luggage. By separately forming of the components of the final formed panel

product, the inner formed fabric 306 may be of a different configuration than the outer formed fabric 304 or the substrate 305. Any such dividers formed and the inner formed fabric shell 306 could be loaded with a rigid substance such as plywood, hardboard, foam or plastic to provide structural support for the divider.

As shown in Figure 18, the sized substrate 308 is formed into a formed substrate 305 in a similar manner as the outer and inner formed fabrics 304 and 306. Initially, the sized substrate is formed into substrate sections 308. The substrate is typically of a rigid construction comprised of polypropolyne, ABS, styrene, PVC or any other substance known in the art or any combination thereof. The substrate is formed by a molding having an open framed female mold 360 and a male mold 362. The actual molding of the sized substrate 308 can be by vacuum molding or any other method of molding known in the art.

Upon forming the formed substrate 305, any excess

substrate around the edge thereof can be trimmed from the formed substrate 308. Next, a contact adhesive 318 is applied to both surfaces of the formed substrate 308.

5        Upon forming the outer formed fabric 304 with welting 345, the formed substrate 305 and the inner formed fabric 306, the components are arranged within a mold having a female compression mold 370 and a male compression mold 376. The components are positioned sequentially and held in place by outer formed fabric clamps 372, formed substrate clamps 373, and inner formed fabric clamps 374 respectively. Typically the clamps 10 372, 373 and 374 are vacuum clamps and positioned on all four sides of each of the components. The female and male components of the mold 370 and 376 respectively may be of relatively inexpensive construction. For example, 15 an epoxy or aluminum female mold may be employed with a neoprene rubber or other such male mold.

After the components of the formed panel are in position, the mold components 372 and 376 close to press

5 the components 304, 305, and 306 together to form the formed panel. The adhesive 318 on the underside of outer formed fabric 304, on both sides of formed substrate 305 and on the top side of the inner formed fabric 306 are contacted and pressed together by female and male mold components 370 and 376. The adhesive 318 is typically a contact adhesive and under pressure forms a bond between the components of the formed panel so that the components of the formed panel are firmly laminated together.

10 The formed panel produced in accordance with this embodiment of the invention results in a rigid formed panel having a soft fabric outer and inner surface.

15 The formed panel produced in accordance with this embodiment of the present invention provides inner and outer fabric outer and inner surfaces that have reduced wrinkles and stretching formed in the manufacturing process. This benefit is obtained by separately forming the components of the formed panel, particularly the inner and outer formed fabrics in spring loaded molds

prior to adhering the components to each other. Additionally, by forming the components separately, waste resulting from a defect in one of the components is confined to that component. As such, an entire laminated panel need not be discarded, but just the component with the defect. Additionally, producing the components separately allows for notches to be formed on the inner fabric for forming compartments in the luggage interior, with the need for forming such notches on the outer fabric on the substrate. Such notches can be reinforced by a rigid material to give the structure strength.

Having thus described my invention in detail, it is to be understood that the foregoing description is not intended to limit the spirit and scope thereof. What is desired to be protected by Letters Patent is set forth in the appended claims.

## CLAIMS

What is claimed is:

1. A method of forming a luggage outer panel comprising the steps of:

5           a) positioning an area of a plastic sheet in contact with an area of fabric at least the size of the plastic sheet;

          b) placing the plastic sheet and the fabric sheet in a mold;

10           c) subjecting the plastic sheet and fabric sheet to pressure and temperature within a molding apparatus to conform the fabric sheet to the plastic sheet and adhere the fabric sheet to the plastic sheet to form a combined sheet; and

15           d) molding the plastic sheet and fabric sheet against a male die to produce a series of ribs in the combined sheet to form a luggage panel.

2. The method of claim 1 wherein the step of molding the plastic sheet and the fabric sheet is done by means of a plug molding apparatus having a male die and a ring which brings the sheets of fabric and plastic down over the male die to subject the sheets to pressure and produces the molding operation.

3. The method of claim 1 wherein the step of molding the plastic sheet and the fabric sheet is done by vacuum-molding.

4. The method of claim 1 including the additional step of trimming the excess from the molded device to form the panel.

5. The method of claim 1 including the additional step of pressing the fabric sheet to the plastic sheet prior to the molding step to form a combined sheet of fabric and plastic.

6. The method of claim 1 where the fabric sheet is a woven fabric and where the plastic from the plastic sheet is forced into the interstices of the woven fabric.

5 7. The method of claim 1 where the molded panel is formed with a series of ribs thereon for strengthening purposes and rigidity purposes.

8. The method of claim 7 where the molded panel is formed to be convex in shape with the ribs on the convex surface of the panel.

10 9. The method of claim 8 wherein the step of subjecting the plastic sheet and fabric sheet to pressure and temperature is performed for 30 to 50 seconds.

15 10. The method of claim 8 wherein the temperature to which the plastic sheet and fabric sheet is subjected is between 120 degrees celsius and 140 degrees celsius.



11. A method of manufacturing fabric-covered plastic panels for luggage panels comprising the steps of:

a) extruding a continuous sheet of thermoplastic material;

b) providing a continuous web of fabric material;

c) directing the web of fabric and the sheet of thermoplastic material through rollers to press the fabric material to the thermoplastic material to form a combined fabric-covered sheet of thermoplastic material;

d) leading the combined sheet of fabric-covered thermoplastic material from the rolling operation to a preserving station;

e) treating the combined sheet of fabric-covered thermoplastic material in the preserving station;

f) cutting the preserved combined sheet of fabric-covered thermoplastic material to form individual sheets suitable for further processing; and

g) conveying the individual sheets formed to a storage area to store the individual sheets.

12. The method of claim 11 wherein the step of pressing the fabric material to the thermoplastic material includes directing the materials over a series of rollers.

5 13. The method of claim 11 wherein the step of directing the materials over a series of rollers to press the materials together includes heating the materials to a temperature between 120°C and 140°C.

10 14. The method of claim 13 further comprising, after the step of pressing the materials together, the step of cooling step of cooling the material while it is being lead from the rollers after pressing.

15. The method of claim 13 wherein the heating step is performed for between 30 and 50 seconds.

16. Deformable luggage with nondeformable external panels comprising:

a gusset section formed from a cloth web;

a plurality of darts formed in the cloth web;

a plurality of zippers sewn to the cloth web to form the darts, each of the plurality of zippers extending continuously around the gusset section to form a continuous dart when the zipper is engaged and to enable expansion of the gusset section when the zipper is fully opened;

a stiffening bar disposed within the gusset section;

a bottom plate fastened to the bottom of the gusset section and to the stiffening bar to support the stiffening bar and to stiffen the bottom of the gusset section;

wheels disposed on the bottom of the gusset section beneath the bottom plate;

connecting means connecting the wheels to the

bottom plate through the gusset section to connect the wheels to the bottom plate and the gusset section so that the wheels can support the luggage;

5 a top plate connected to the top of the stiffening bar;

handle means disposed atop of the gusset section;

10 connecting means connecting the handle means to the gusset section, the top plate and the stiffening bar to enable the handle to support the luggage;

a back panel comprising:

a sheet of rigid plastic material;

15 a sheet of fabric impressed onto the sheet of rigid plastic material forming a combined material, the combined material molded to form a convex panel having front, back, top and bottom ends and a large planer section, the planer section having a plurality of stiffening ribs molded therein, the ends of the back panel being connected to the back side of the gusset

section by connecting means comprising:

a welting bead having a core member,  
a panel leg and a gusset leg, the panel leg being  
connected to back panel by thread means, and the gusset  
leg being connected to the rear portion of gusset section  
by thread means;

a front panel comprising:

a sheet of rigid plastic material;

a sheet of fabric impressed onto the sheet  
of rigid plastic material forming a combined material,  
the combined material molded to form a convex panel  
having front, back, top and bottom ends and a large  
planer section, the planer section having a plurality of  
stiffening ribs molded therein, the ends of the front  
panel being connected to the front side of the gusset  
section by connecting means comprising:

a welting bead having a core member,  
a panel leg and a gusset leg, the panel leg being  
connected to the front panel by thread means, and the

gusset leg being connected to the rear portion of gusset section, by thread means, the welting extending along bottom to form a hinge means to allow the front panel to open pivotally from the luggage to gain access to the contents of the luggage; and

zipper means securing the front panel to the gusset section, the zipper extending about the top, front and back of the luggage at a position adjacent to the welting along the bottom of the luggage, the zipper means having two halves, the first half of the zipper connected to the front of the gusset section and the second half of the zipper connected to the top, front and back ends of the front panel so that closure of the zipper secures the front panel to the gusset section.

17. A hard panel with storage means for luggage having hard panels and a gusset section comprising:

a sheet of rigid plastic material;

a sheet of fabric impressed onto the sheet of rigid plastic material forming a combined sheet,

the combined sheet molded together to form a convex panel having front and back and top and bottom ends and a large planer section,

the planer section having a plurality of stiffening ribs molded therein,

the ends of the back panel being connected to the back side of the gusset section by connecting means comprising:

a welting bead having a core member, a panel leg and a gusset leg,

the panel leg of the welting being connected to the back of the panel by thread means,

the gusset leg being connected to the rear portion of gusset section by thread means;



pocket means formed from fabric,

the pocket means attached to the outer surface of the combined sheet, comprising:

5 a web of fabric forming a bottom pocket portion; a web of fabric forming a top pocket portion; and

zipper means connecting the top pocket portion to the bottom pocket portion.

18. The apparatus of claim 17 wherein the attachment of the pocket means to the combined material comprises stitches extending through the pocket means and the fabric, the stitches being stitched prior to the impression of the fabric onto the rigid plastic.

19. The apparatus of claim 17 wherein the attachment of the pocket means to the combined material comprises stitches extending through the combined material.

20. A rigid end compartment for soft luggage comprising:

a gusset section formed from a cloth web, the gusset section having an end; and

a rigid panel comprising:

5 a sheet of rigid plastic material; and

a sheet of fabric impressed onto a rigid panel forming a combined material, the combined material molded to form a convex panel having front, back, top and bottom ends and a large planer section, the planer section having a plurality of ribs molded therein, the ends of the back panel being connected to the end of the gusset section by connecting means comprising a welting bead having a core member, a panel leg and a gusset leg, the panel leg being connected to the rigid panel and the gusset leg being connected to the end of the gusset section.

10

15

21. The rigid end compartment for soft sided luggage of claim 20 further comprising:

5 a second rigid panel comprising a shell of rigid plastic material and a sheet of fabric impressed onto the rigid panel forming a combined material, the combined material molded to form a convex panel having front, back, top and bottom ends and a large planer section having an edge extending about its perimeter, the planer section having a plurality of ribs molded therein, 10 the ends of the second panel being connected to the gusset section at a position inward from the end of the gusset section by a connecting means comprising:

15 a first welting bead having a core member, a panel leg and a gusset leg, the panel leg being connected to the edge of the large planer surface of the second rigid panel, and the gusset leg being connected to the gusset section; and

a second welting bead having a core member, a panel leg and a gusset leg, the panel leg being

connected to the end of the second rigid panel, and the gusset leg being connected to the gusset section positioned between the first and second rigid panels.

22. Deformable luggage having hard panels comprising:

a fabric gusset;

stiffening means disposed within the fabric gusset to form a continuous band within the gusset;

5 handle means disposed on top of the external surface of the flexible gusset;

connecting means connecting the handle to the stiffening means within the gusset to support the luggage;

10 a rigid back panel;

connecting means connecting the rigid back panel to the flexible gusset to secure the back panel to the flexible gusset;

a rigid front panel;

15 hinge means connecting the rigid front panel to the flexible gusset to pivotally connect the front panel to the flexible gusset; and

securing means to releasably secure the front panel to the flexible gusset.

23. The apparatus claim 22 further comprising a plurality of zippers sewn to the flexible gusset to form darts, each of the plurality of zippers extending continuously around the gusset section to form a continuous dart when the zipper is engaged and to enable expansion of the gusset section when the zipper is fully opened.

24. The apparatus claim 22 wherein the means for connecting the rigid back panel to the flexible gusset comprises a welting bead having a core member, a panel leg and a gusset leg, the panel leg being connected to back panel by thread means, the gusset leg being connected to the rear portion of gusset section by thread means, the welting extending about the top, bottom, front and back of the luggage.

25. The apparatus claim 22 wherein the hinge means comprises a welting bead having a core member, a panel leg and a gusset leg, the panel leg being connected to the front panel by thread means, the gusset leg being connected to the front portion of flexible gusset by thread means, the welting extending along bottom of the flexible gusset and the rigid front panel to form a hinge means to allow the front panel to open pivotally from the luggage to allow access to the contents of the luggage.

26. The apparatus claim 25 wherein the securing means comprises zipper means securing the front panel to the flexible gusset, the zipper extending about the top, front and back of the luggage, the zipper means having two halves, the first half of the zipper connected to the front of the flexible gusset and the second half of the zipper connected to the top, front and back ends of the front panel so that closure of the zipper secures the front panel to the gusset section.



27. The apparatus claim 22 wherein the rigid back panel comprises:

a sheet of rigid plastic material;

a sheet of fabric impressed onto the sheet of rigid plastic forming a combined material, the combined material molded together to form a convex panel having front and back and top and bottom ends and a large planer section, the planer section having a plurality of stiffening ribs molded therein.

28. The apparatus claim 27 wherein the rigid front panel comprises:

a sheet of rigid plastic material;

a sheet of fabric impressed onto the sheet of rigid plastic forming a combined material, the combined material molded together to form a convex panel having front and back and top and bottom ends and a large planer section, the planer section having a plurality of stiffening ribs molded therein.

29. The apparatus claim 28 wherein the rigid plastic material of the front and back panels are formed of one of Acrylic Buterate Styrene, Poly Vinyl Chloride, Poly Ethylene, Poly Propylene or pack.

30. The apparatus claim 22 further comprising a bottom plate fastened to the bottom of the flexible gusset and to the stiffening band to support the stiffening band and to stiffen the bottom of the flexible gusset.

31. The apparatus claim 30 further comprising wheels disposed on the bottom of the flexible gusset beneath the bottom plate, and connecting means connecting the wheels to the bottom plate through the flexible gusset to connect the wheels to the bottom plate and the flexible gusset so that the wheels can support the luggage.

32. The apparatus claim 29 wherein the fabric and the flexible gusset are made of the same material.

33. A formed panel for a bag comprising a resin panel and a raw material which is adhesively deposited on the resin panel, wherein the resin panel and the raw material are integrally extruded and formed.

5 34. A formed panel according to claim 33, wherein fabric is used as said raw material.

35. A formed panel according to claim 33, wherein leather is used as said raw material.

10 36. A formed panel according to claim 33, wherein vinyl is used as said raw material.

37. A method of manufacturing a formed panel for a bag comprising the steps of:

adhering a raw material onto a resin panel;

5 heating the resin panel adhered with the raw material for 30 to 50 seconds;

extruding and forming the heating resin panel by using a plug molding press to produce a formed product;

cooling the formed product; and

10 cutting a scrap of the periphery of the formed product to complete a formed panel.

38. A method of manufacturing a formed panel for a bag comprising the steps of:

contacting a raw material to a resin panel extruded from a extruder;

5           adhering the raw material with the resin panel over an extruding and forming process;

          performing a cooling and carrying process to the resin panel adhered with the raw material to obtain a formed product; and

10           cutting the formed product obtained through the cooling and carrying process to predetermined lengths in a cutting process.

39. A method of manufacturing a formed panel for luggage comprising the steps of:

providing a sized fabric with adhesive on one side thereof;

5 heating the adhesive to provide flexibility to the sized fabric;

molding the sized fabric to form an outer formed fabric;

10 providing a second sized fabric with an adhesive on one side thereof;

heating the adhesive to provide flexibility to the sized fabric;

molding the sized fabric to form an inner formed fabric;

15 providing a sized substrate;

molding the sized substrate to a formed substrate;

applying adhesive to both surfaces of the formed substrate;

stacking the outer formed fabric, the formed substrate and the inner formed fabric; and

compressing the outer formed fabric, the formed substrate and the inner formed fabric together so that the surfaces containing adhesive contact and coact to laminate the outer formed fabric, the formed substrate and the inner formed fabric together to form a formed panel.

40. The apparatus of claim 39 wherein the step of providing the sized fabric comprises the steps of:

removing the fabric from a roll;

applying adhesive to the fabric;

drying the adhesive onto the fabric; and

cutting the fabric into sized pieces.

41. The method of claim 40 further including, after the step of forming the outer formed fabric, the step of cutting away the excess material from the edge of the outer formed fabric.

5 42. The method of claim 41, further including, after the step of forming the inner formed fabric, the step of cutting the excess material from the edge of the inner formed fabric.

10 43. The method of claim 42 further including, wherein after the step of forming substrate, the step of cutting the excess material from the edge of the formed substrate.

15 44. The method of claim 43 further including, the step of forming notches on the inner fabric for forming compartments within the luggage.



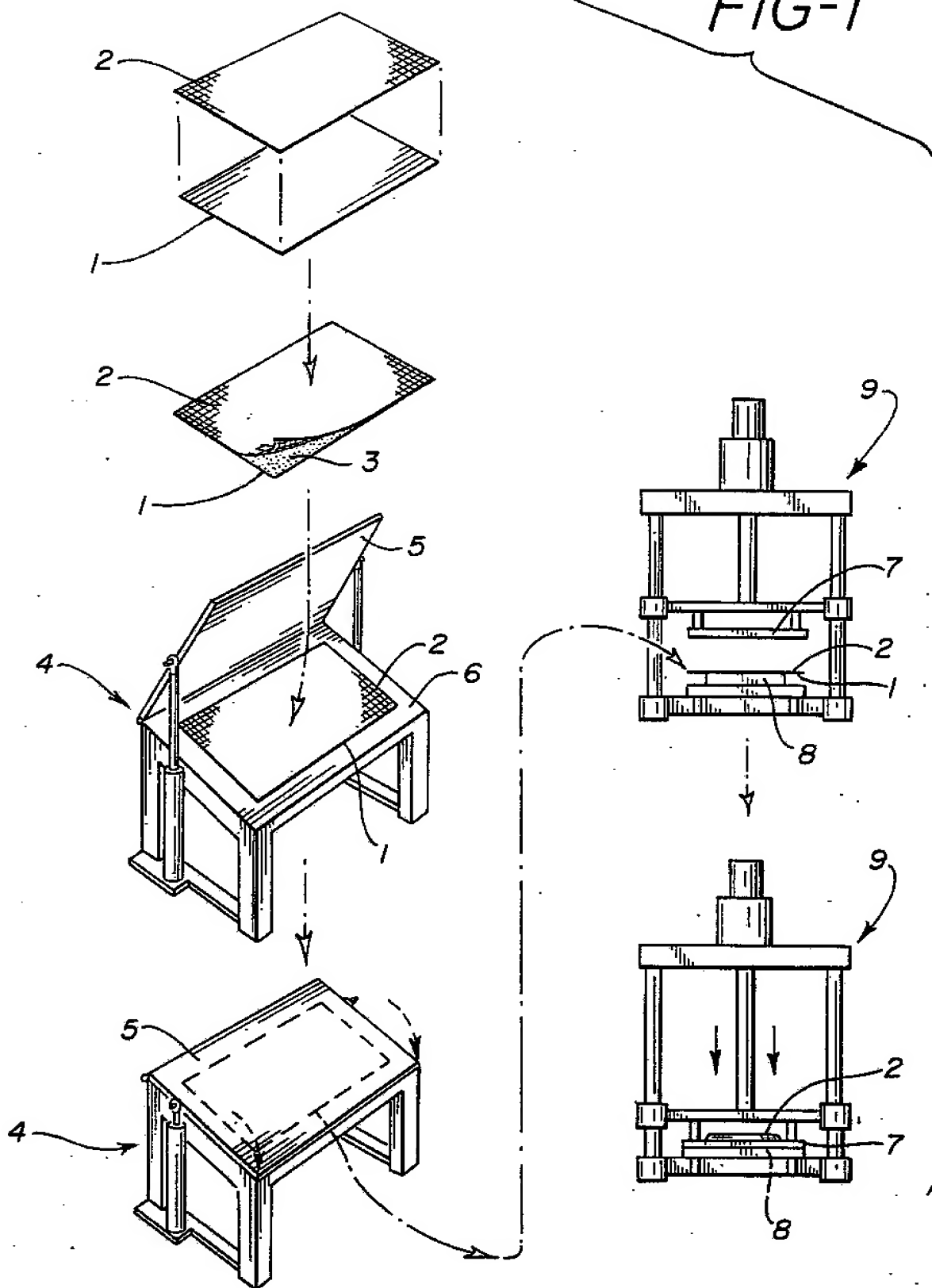
45. The method of claim 44 further including the step of inserting a stiffening material into the notches to form solid compartments within the luggage.

46. The method of claim 44 further including, during the step of forming the outer formed fabric, the step of forming ridges on the outer formed fabric.

47. The method of claim 44 further including, during the step of forming the inner formed fabric, the step of forming ridges on the inner formed fabric.

48. The method of claim 44 further including, during the step of forming the substrate, the step of forming ridges on the substrate.

FIG-1



SUBSTITUTE SHEET

FIG-2

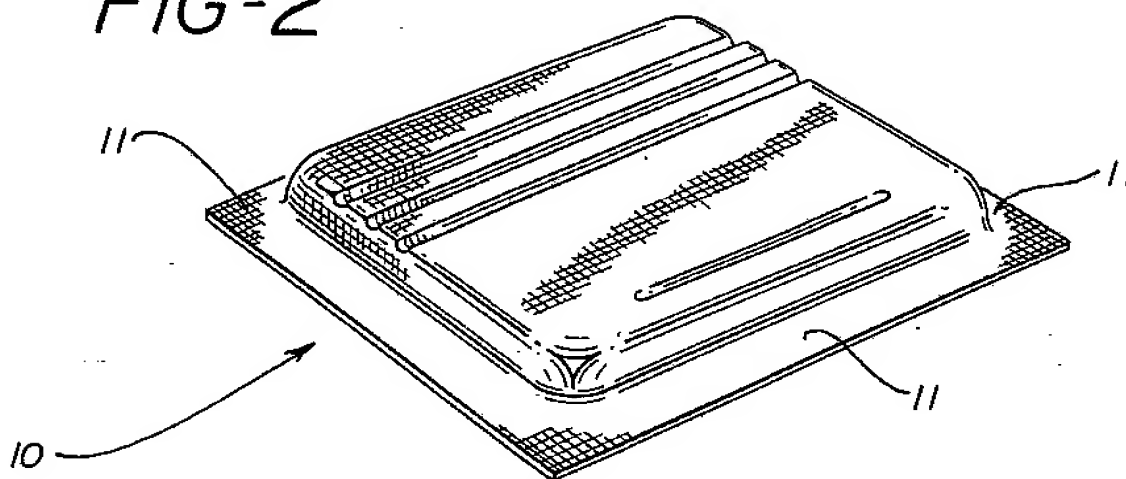


FIG-3

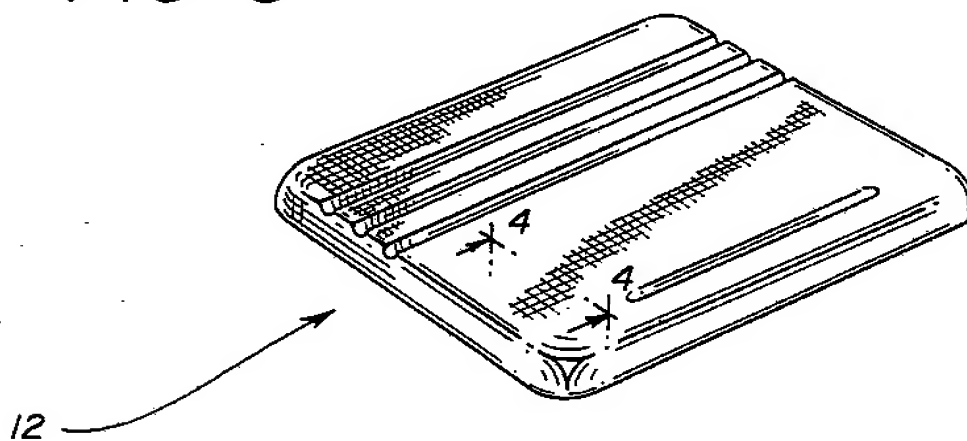
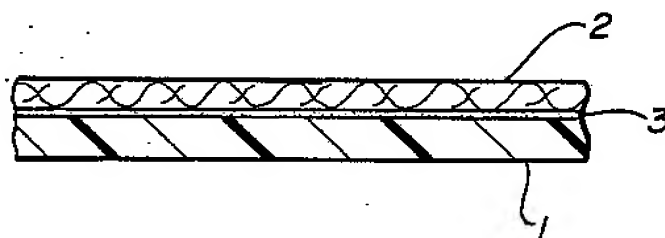


FIG-4



SUBSTITUTE SHEET

FIG-5

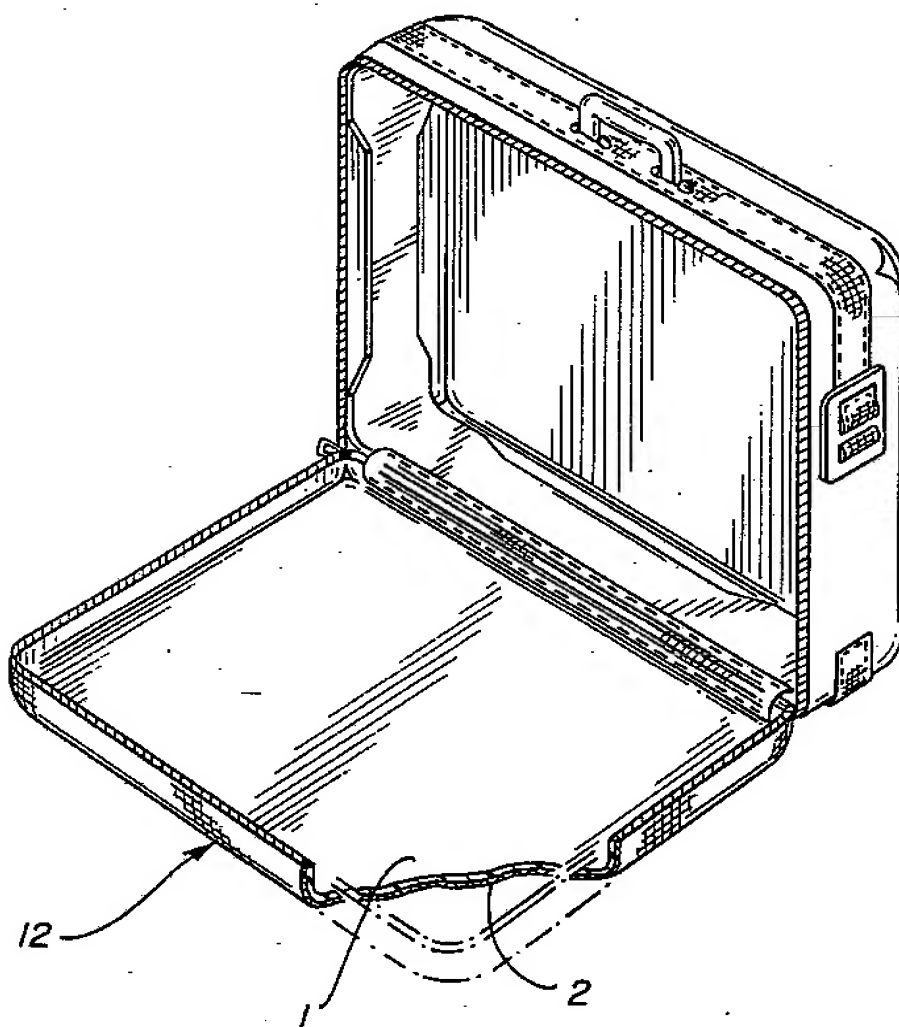
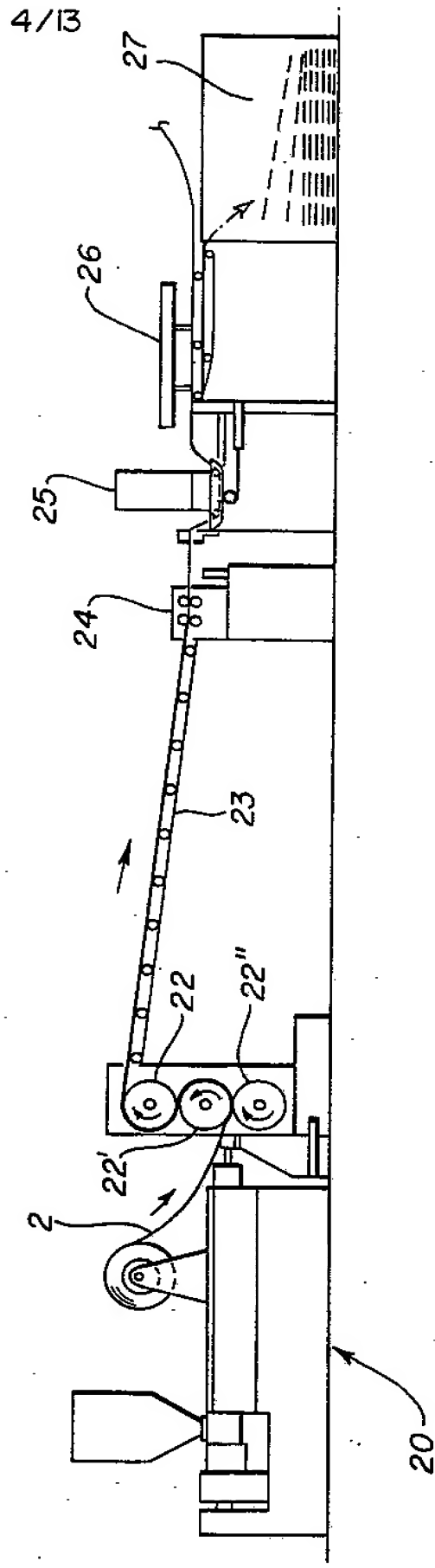
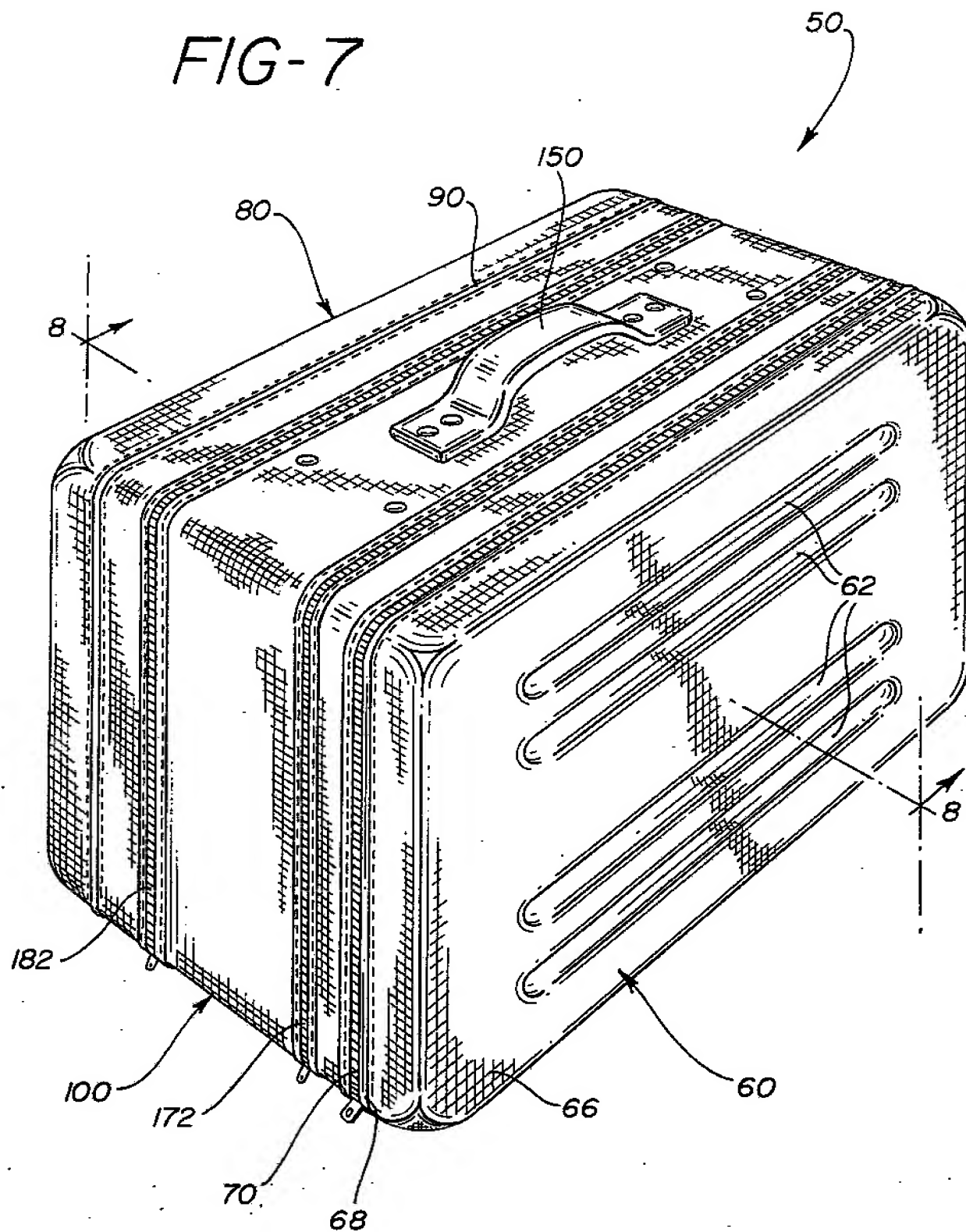


FIG-6



5/13

FIG-7



SUBSTITUTE SHEET

6/13

FIG-8

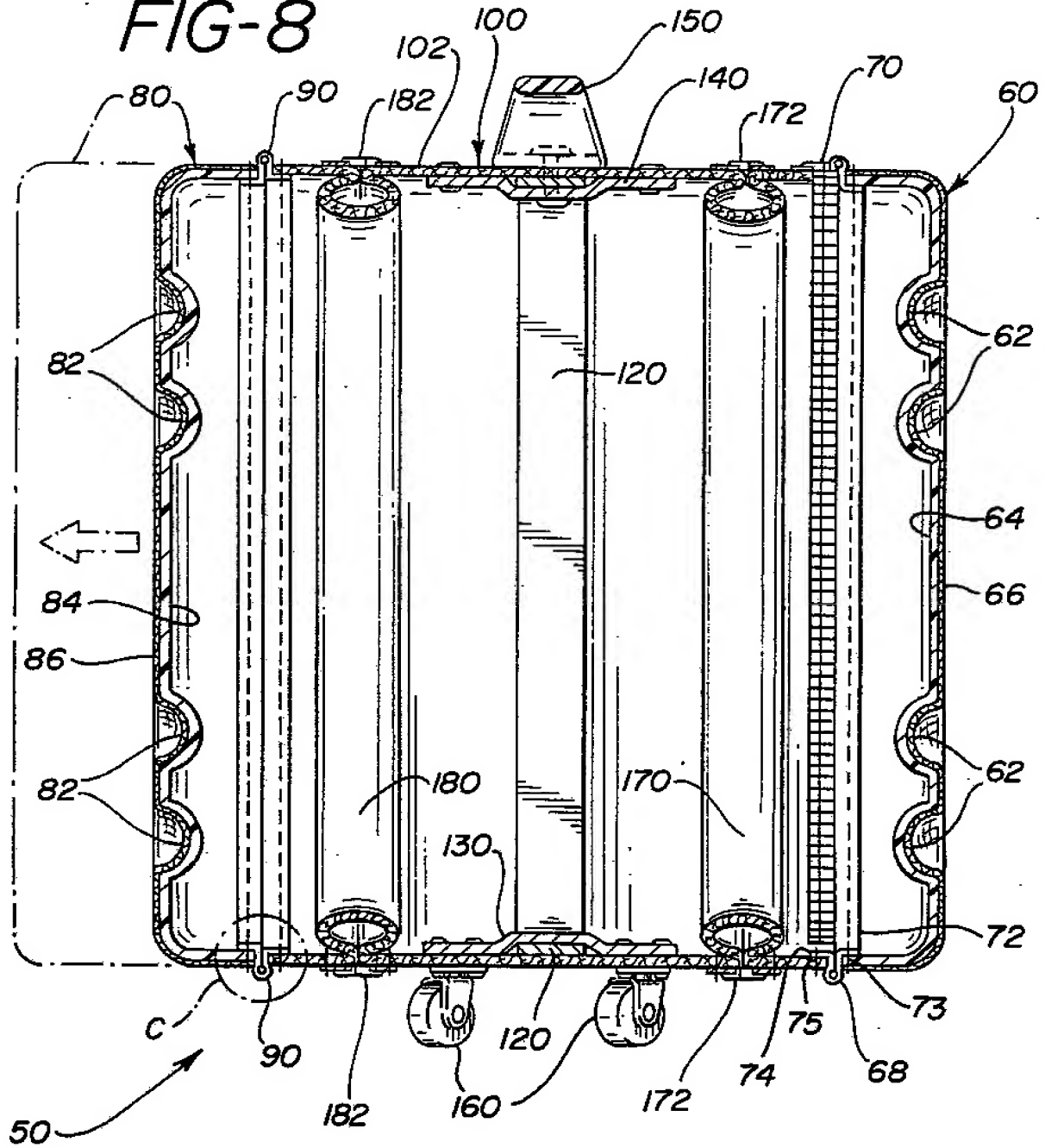
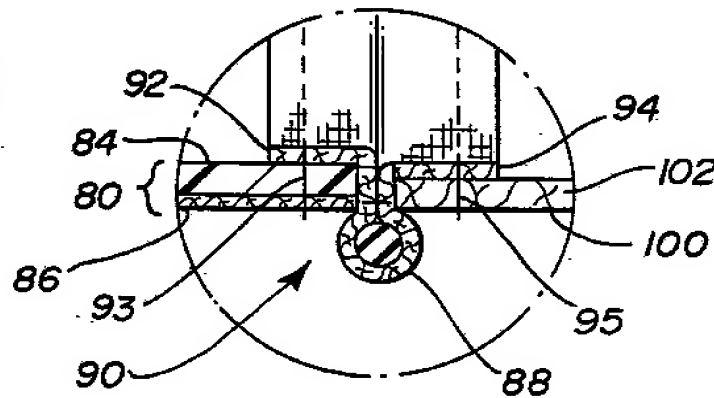
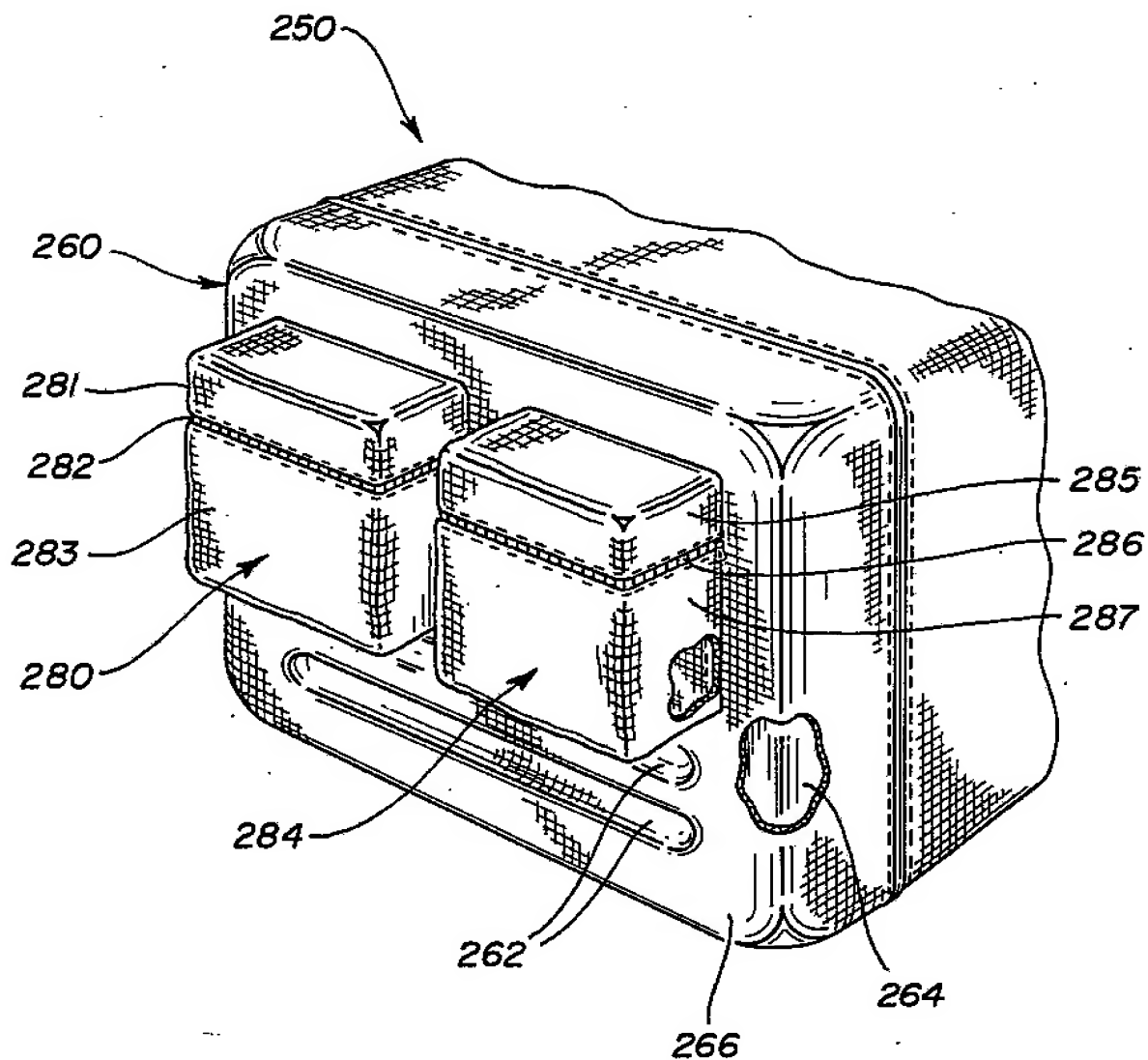


FIG-9



SUBSTITUTE SHEET

FIG-10





8/13

350

FIG-11

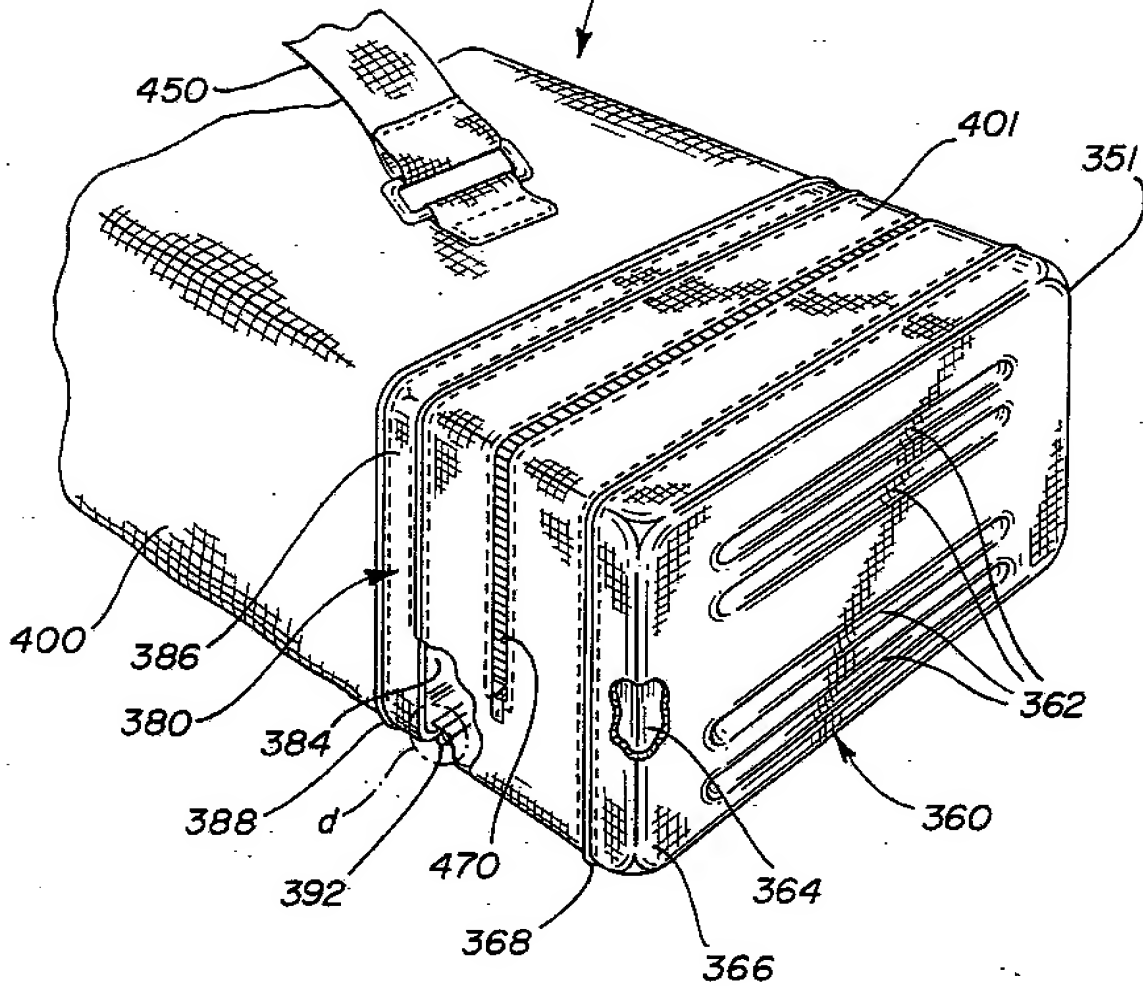
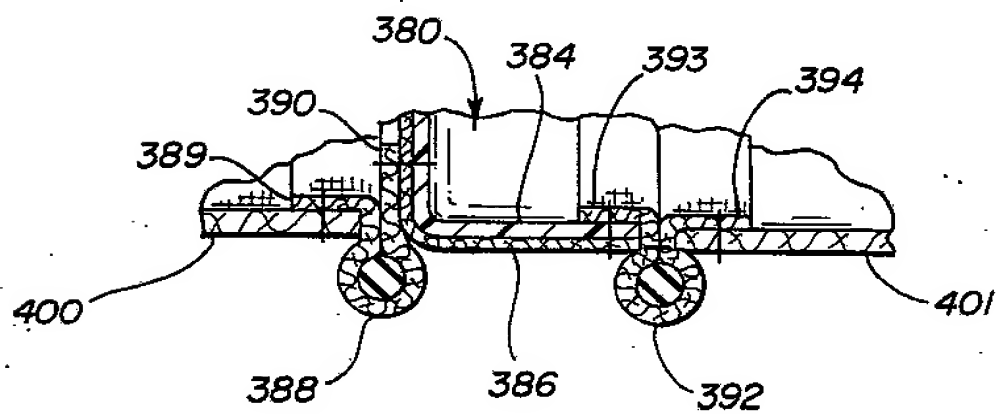
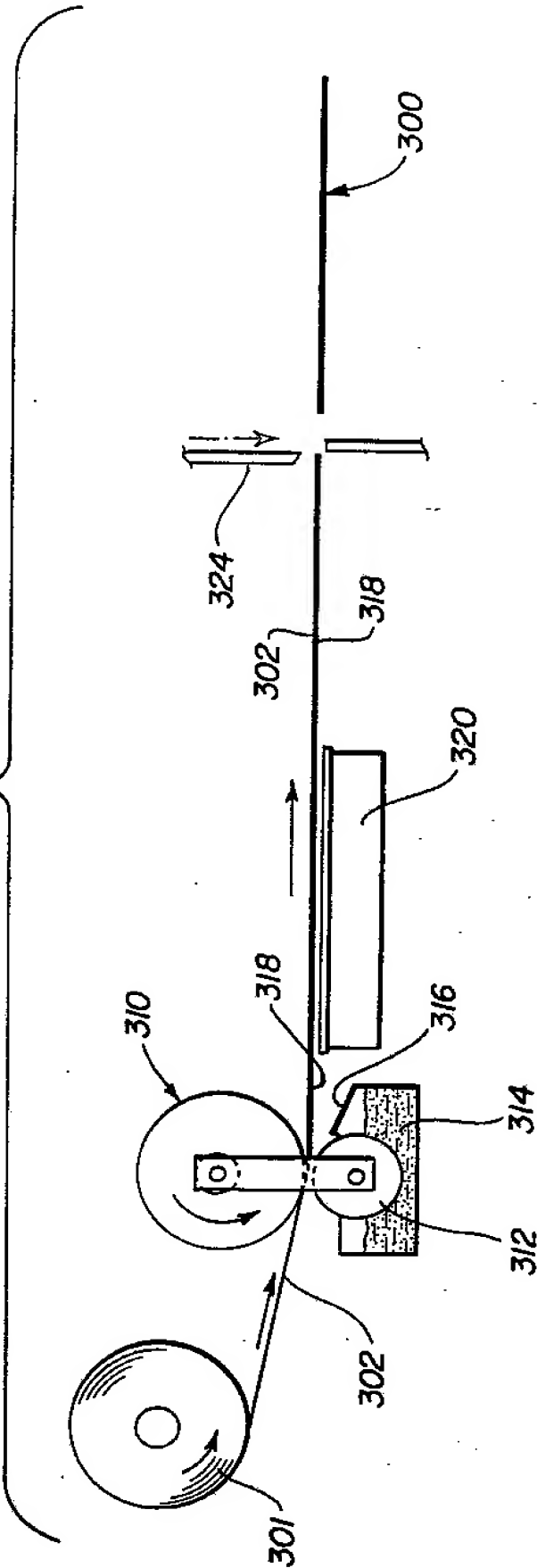


FIG-12



9/13

FIG-13



SUBSTITUTE SHEET

10/13

FIG-14

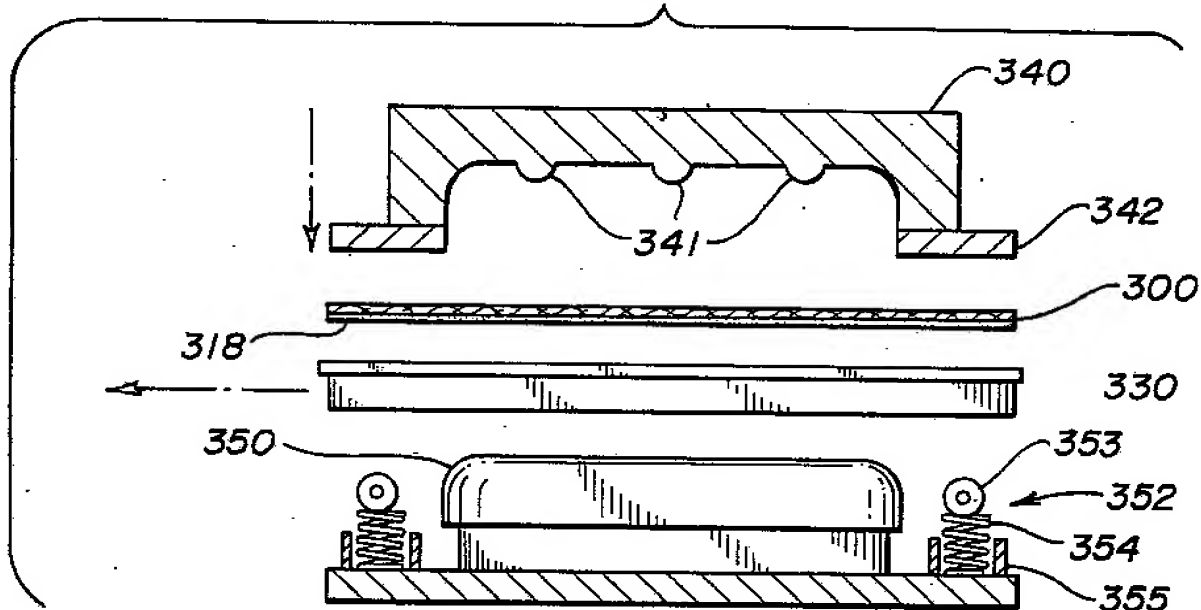
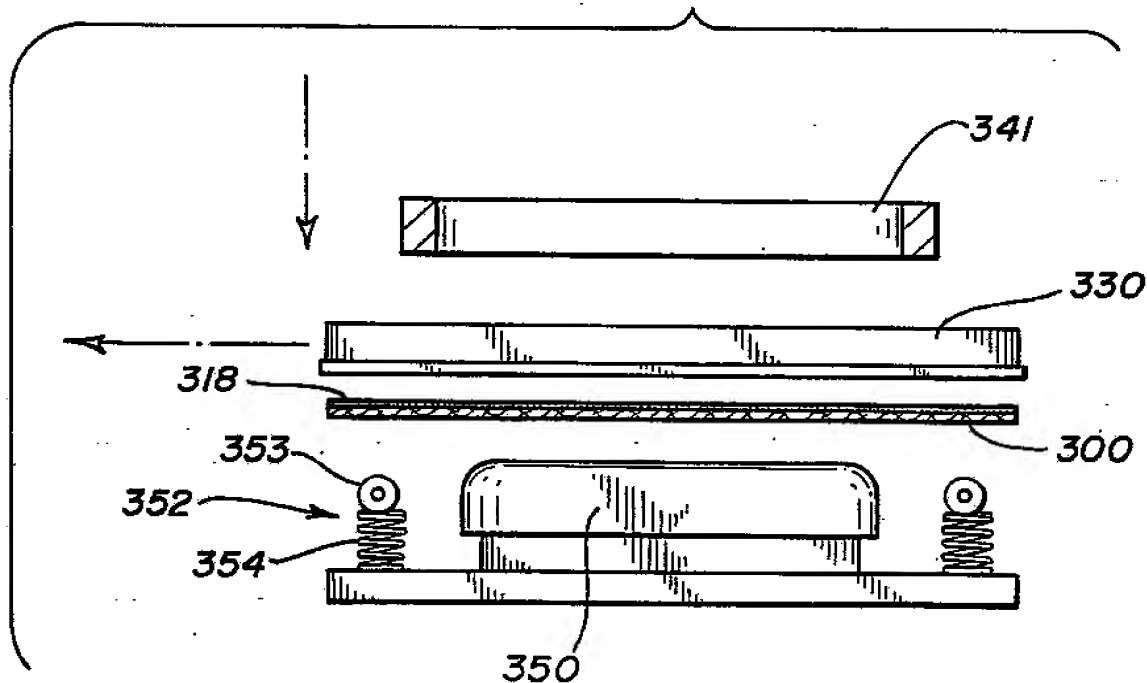


FIG-15



SUBSTITUTE SHEET

FIG-16

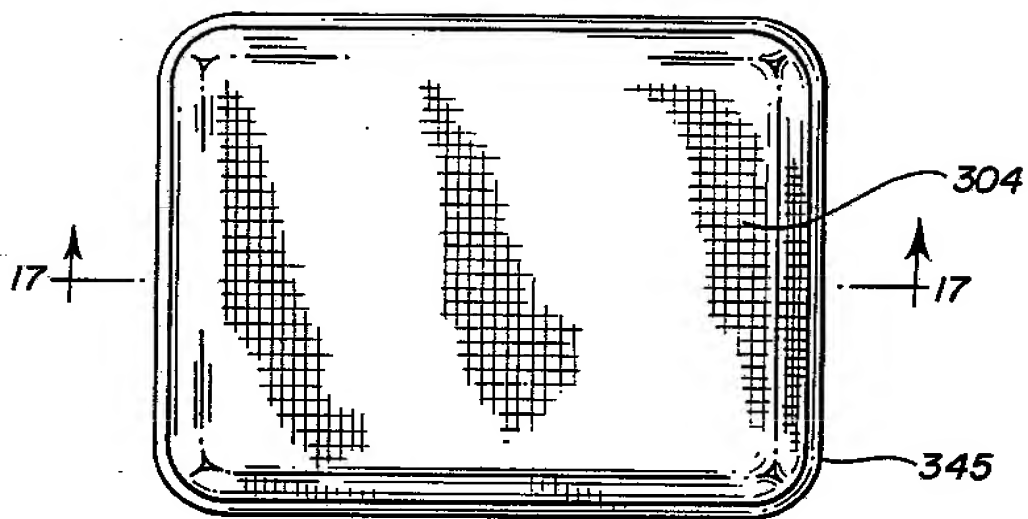
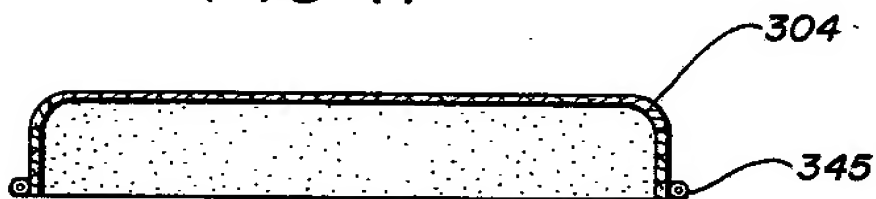


FIG-17



12/13

*FIG-18*

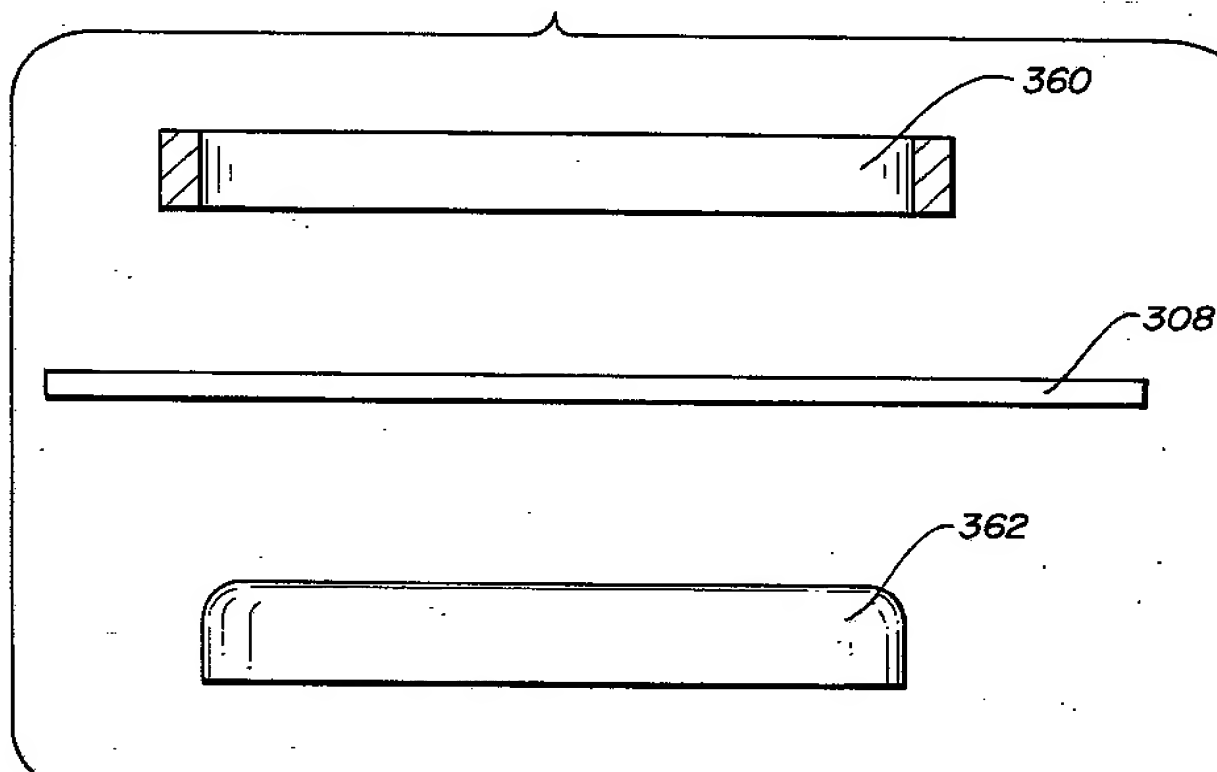
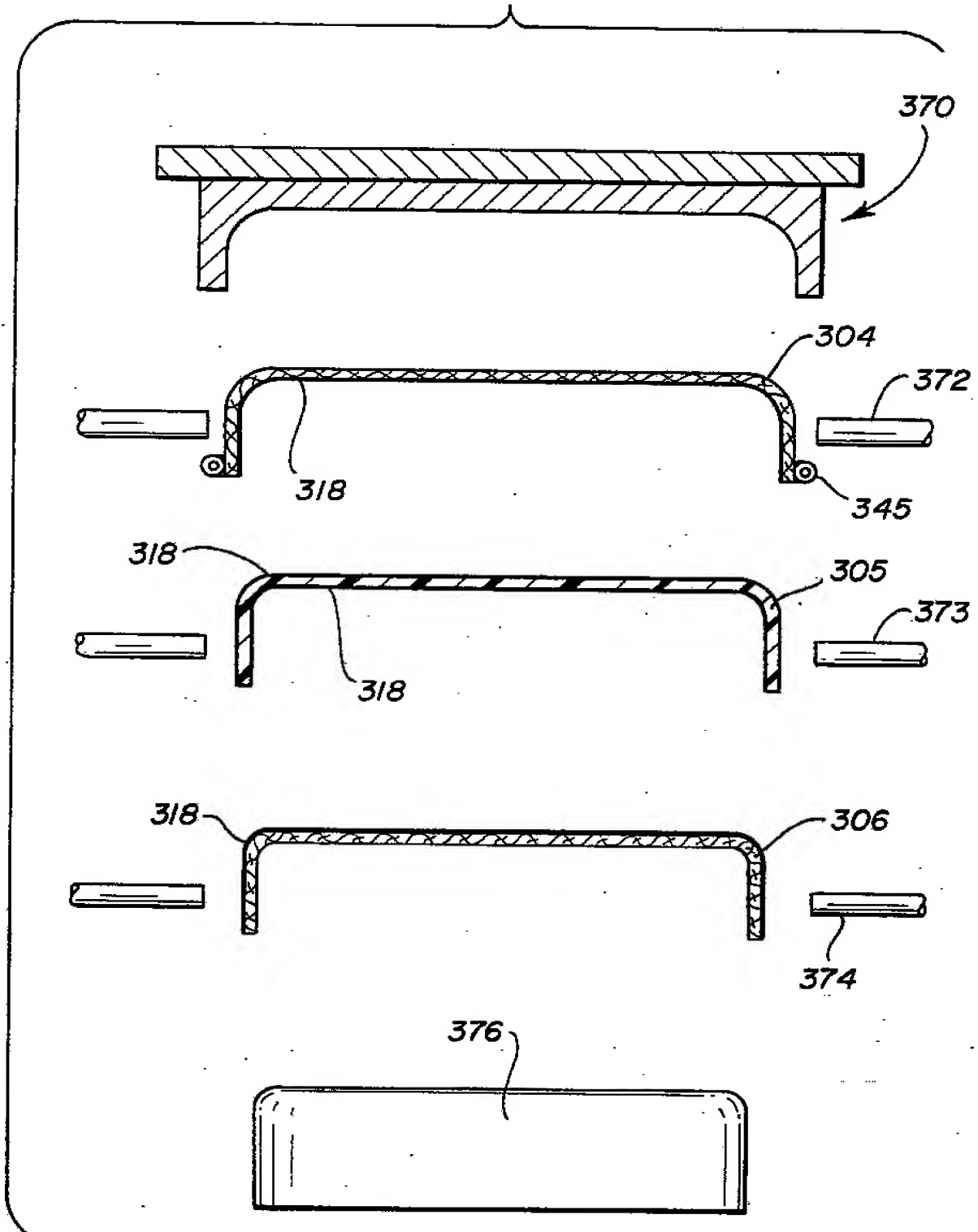


FIG-19



## INTERNATIONAL SEARCH REPORT

PCT/US92/08095

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :B29C 43/04, 47/06; B32B 31/20

US CL :156/196

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 156/196 156/242,244.11,244.23,244.24,245,285; 190/18A,100,103,104,105,108,112,115,124,125,903

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A         | US,A, 3,544,418 (Holtzman) 01 December 1970 column 2, lines 46-64.                 | 17-21                 |
| A         | US,A, 4,128,150 (Popkin et al.) 05 December 1978 Entire document.                  | 1-47                  |
| A,P       | US,A, 5,065,847 (Hsieh) 19 November 1991 Entire document.                          | 1-10 and 39-47        |
| A,P       | US,A, 5,105,920 (Greibenstein) 21 April 1992 Entire document.                      | 1-47                  |
| A,P       | US,A, 5,132,166 (Adams et al.) 21 July 1992 Entire document.                       | 1-10 and 39-47        |

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

|   |  |
|---|--|
| * Special categories of cited documents:  | * later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
| *A* document defining the general state of the art which is not considered to be part of particular relevance   | *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone   |
| *E* earlier document published on or after the international filing date  | *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | *Z* document member of the same patent family  |
| *O* document referring to an oral disclosure, use, exhibition or other means  |  |
| *P* document published prior to the international filing date but later than the priority date claimed  |  |

Date of the actual completion of the international search

03 DECEMBER 1992

Date of mailing of the international search report

23 DEC 1992

 Name and mailing address of the ISA/ *us*  
 Commissioner of Patents and Trademarks  
 Box PCT  
 Washington, D.C. 20231

Facsimile No. NOT APPLICABLE

Authorized officer

*m* CALEB WESTON

Telephone No. (703) 308-1980

*Nguyen Ngoc Ho*  
 NGUYEN NGOC HO  
 INTERNATIONAL DIVISION

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US92/08095

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A,P       | GB,A, 2,245,250 (Davis) 02 January 1992 Entire document.                           | 16-32                 |